Reforesting BC's Public Land – An Evaluation of Free-Growing Success

Special Report

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Executive Summary

British Columbia is proud of its sustainable forest management practices. BC's trees are a renewable resource. Following the logging of public land, forest companies are required to reforest the site with native species, establishing a new crop of trees. Each year, more than 200 million seedlings are planted in BC. Forest companies are then required to tend those trees for a number of years, to ensure they survive and grow into a healthy new forest. Once they reach this stage, called 'free growing,' the companies are relieved of their responsibility to look after the trees and they once again become the responsibility of the Crown.

The public hears a great deal about the number of trees that are planted in BC each year, but what becomes of them? How many survive to become a healthy new forest? In 2002, the Forest Practices Board decided to investigate the achievement of free growing for new forests across British Columbia. This was accomplished through a combination of field review and analysis of the Ministry of Forests' silviculture database, which keeps track of reforested sites across the province.

Achievement of free growing is also an example of results-based forestry and provides an interesting case study for assessing this approach to forest management. Forest companies are required to achieve free-growing status within a certain time period, but they are not told how to do that. It is up to the companies to meet the free-growing standard however they choose.

The free-growing requirements have only existed since 1987, with the introduction of the *Silviculture Regulation*. It takes quite a few years for a new forest to become free growing. Depending on the species of trees and the local climatic conditions, this can range from 11 to 20 years.

The time frame of this study covers cutblocks that were approved after October 1987 and harvested before December 1992. Across the province, 6,488 cutblocks were required to be free growing by August 2002. Forest tenure types include major licensees, woodlot licensees and the Ministry of Forests' Small Business Forest Enterprise Program.

The investigation had four objectives:

1. To determine the accuracy of record keeping; that is, did the silvicultural records and surveys reflect what was observed on the ground?

2. To verify on the ground, for 291 cutblocks in 6 forest districts, whether:

   (a) the cutblocks actually met the criteria for free growing; and

   (b) the cutblocks remained free growing after declaration, or whether they had been overcome by insects, disease, brush, landslides or fire.

3. To assess compliance with the free-growing requirements of the *Forest Practices Code of British Columbia Act* and related regulations (the Code) for the cutblocks examined on the ground.

4. Based on the silviculture database, to survey for all forest districts in the province:

   (a) the success in achieving free growing within the prescribed time period;

   (b) the number of cutblocks that required amendments to the silviculture prescription because they would not meet free-growing specifications within the prescribed time period; and

   (c) the number of cutblocks that did not meet the free-growing requirements, and the reason why not.

The results were:

1. Overall the silvicultural records, maps and databases were accurate and fairly represented what was observed on the ground.

2. Field examination of 291 cutblocks that were declared free growing in six forest districts showed excellent results on the ground. Overall, 99 percent of the total net area to be reforested (NAR) was stocked with conifers and was free of brush competition. The 291 cutblocks were specifically selected because they had a higher risk of not achieving free growing. The areas that were not free growing amount to approximately one to two percent of the total area.

3. In all significant respects, the licensees in the six sample districts are in compliance with Forest Practices Code requirements for free growing.

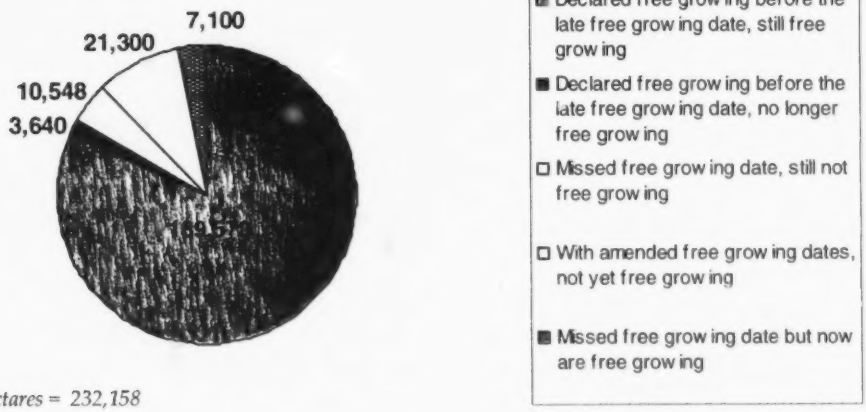
4. Based on the silviculture database, for all forest districts in the province:

   (a) Provincially, 82 percent of cutblocks met the original free-growing date and are still free growing. On average, free growing was achieved three years before the prescribed deadline. An additional three percent missed the original free-growing date, but are now free growing. Together, this represents 85 percent of the net area to be reforested.

   (b) Nine percent of cutblocks were amended to extend the free-growing due date.

   (c) Four and a half percent of cutblocks have not yet achieved free growing. Based on our field observations, the majority of the cutblocks that did not achieve the free-growing date are regenerated, but are not declared free growing because brush occupies a portion of the cutblock. Finally, 1.5 percent of cutblocks met the original free-growing date, but are no longer free growing.

Cutblocks Scheduled to be Free Growing by August 2002 *(in hectares)*


7,100
21,300
10,548
3,640
Declared free growing before the late free growing date, still free growing
Declared free growing before the late free growing date, no longer free growing
Missed free growing date, still not free growing
With amended free growing dates, not yet free growing
Missed free growing date but now are free growing

Total Hectares = 232,158

These early results from the first set of cutblocks harvested under the objectives of the *Silviculture Regulation* are very encouraging. They are the net result of hard work and cooperation by licensee and government foresters, technicians, seedling producers and silviculture workers. The people involved deserve congratulations.

The science of forestry has become increasingly complex since the silviculture prescriptions for these cutblocks were written some 10 to 15 years ago. Other objectives, such as biodiversity and wildlife habitat, have become more important. Practices such as large clearcuts, broadcast burning and herbicide application have become less acceptable to the public. Balancing these competing objectives, while still achieving free growing, is more complex. It may be more difficult to accommodate free-growing objectives in silviculture prescriptions in the future.

Free-growing objectives were the first clearly-established objectives in the Forest Practices Code. Free growing is a desired result with clearly specified indicators for measuring success. There are no legislated steps that must be followed to achieve it—professionals must use their judgment and apply appropriate prescriptions and treatments to obtain a free-growing stand of trees. The free-growing example provides a track record and reassurance that licensees and forestry professionals are up to the task, provided they are given clear and measurable objectives to aim for, and measurable standards to assess progress along the way.

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Introduction

British Columbia prides itself on its program of reforestation. The public expects that sustainable new forests will replace the approximately 5,000 cutblocks harvested each year. Timely establishment of new trees is necessary to meet public expectations for future timber supply, biodiversity and watershed recovery.

After logging an area, forest companies must create a "free-growing" new forest of appropriate tree species and the desired number of trees within a defined time period. Many cutblocks logged in the late 1980s and early 1990s should now be re-established with free-growing stands of new trees.

There are two compelling reasons for the Board to examine free growing at this time. Sustainability and reforestation are among the public's top concerns about forest practices today. The public often hears about how many seedlings have been planted, but what about the long-term fate of these trees? The first population of free-growing stands is now coming on stream. Over the next few years, thousands of new cutblocks will be declared free growing. This study provides an opportunity to assess licensee success in achieving free-growing stands and provides a benchmark for future surveys. This is accomplished through a combination of field verification and analysis of the Ministry of Forests' Integrated Silviculture Information System (ISIS) database.

Secondly, the obligation to create a free-growing stand is one of the few measurable results under the *Forest Practices Code of British Columbia Act*. The new *Forest and Range Practices Act*, introduced in November 2002, will place much more emphasis on results. There is considerable public debate over whether a regulatory system based on measurable results will work. Achievement of free growing is an example of results-based forestry and provides an interesting case study for assessing this approach to forest management.

Background

Since 1987, forest companies have been legally obligated to establish a free-growing stand after logging. The intent is to reforest harvested areas as quickly as possible to provide timber and other forest values for future generations. A site is considered successfully reforested when it is declared satisfactorily restocked by the regeneration date; free-growing requirements ensure it remains so. Once declared free growing, the Crown assumes responsibility for the ongoing maintenance of the site.

There are a number of requirements that must be met for a stand to be declared free growing (see Appendix 1). In summary, the new stand must have a minimum number of well-spaced

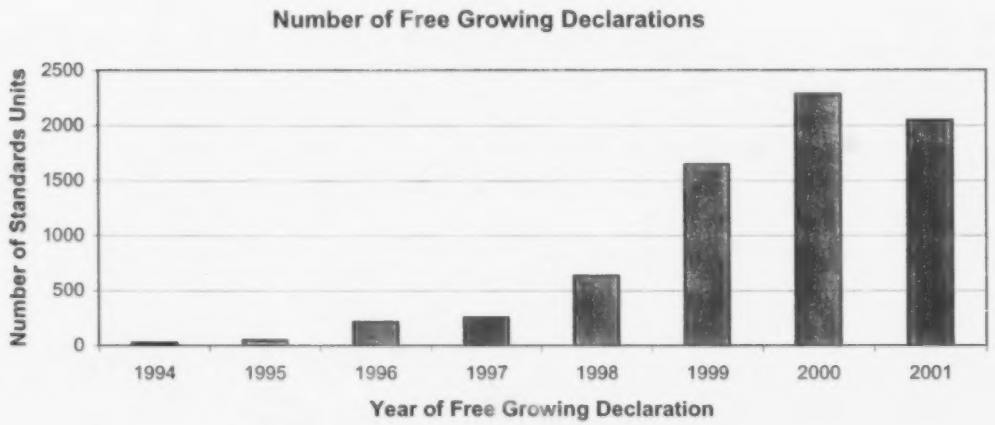
crop trees on site (but below a maximum density) that are healthy and free of brush competition. Guidance is provided in the *Establishment to Free Growing Guidebooks* (MOF 2002).

The Forest Practices Code requires silviculture prescriptions to include a time frame for establishment of a new stand and for the stand to achieve free growing. Guidelines for establishing free-growing timeframes are described in the *Establishment to Free Growing Guidebooks*. The free-growing timeframe becomes a legal standard when put into the silviculture prescription. The "latest free-growing date" is the latest date specified in the silviculture prescription (SP)[1] by which the stand must be free growing.

Free-growing obligations are tracked to the month in the Ministry of Forests ISIS database. On or before the latest free-growing date, a survey must be done to determine whether the number of healthy free-growing trees per hectare meets the requirements specified in the silviculture prescription.

The number of cutblocks declared free growing was few in 1994, but increased dramatically in 1999 (Figure 1). The last three years have seen approximately 2,000 free-growing declarations per year.

Figure 1. Number of cutblocks declared free growing by year



[1] Prior to the *Forest Practices Code of British Columbia Act*, silviculture prescriptions were called pre-harvest silviculture prescriptions (PHSPs). For simplicity all PHSPs and SPs will be referred to as SPs in this report.

Previous Forest Practices Board Silviculture Audits

Since 1996, the Board has carried out 20 compliance audits that looked at silviculture activities. Eighteen of the audits found substantial compliance with the Forest Practices Code, though the population of free-growing cutblocks examined was very small. One audit found significant non-compliance with free-growing obligations and one audit found forest health concerns that may, in future, affect cutblocks recently declared free growing.

The Fort Nelsen area-based audit (2002) found that 13 out of 15 cutblocks did not have free-growing stands established within the time specified in the silviculture prescription. These were cottonwood stands logged between 1987 and 1991.

The Nisga'a audit (2003) did not find any problems with achievement of free-growing stands, however the audit noted the incidence of Dothistroma needle blight in cutblocks planted with lodgepole pine, and cautioned about the potential effect on free-growing, or soon to be declared free-growing, trees.

Project Scope

The data compiled for this report was current as of August 2002. The rules used to measure compliance were the 2002 version of the Code (pre-Bill 75).

The analysis is provincial in scope; free-growing status is examined for all cutblocks required to be free growing by August 2002. The time frame covered includes cutblocks where the silviculture prescription was approved after October 1987 and harvesting took place before December 1992. Forest tenure types include major licensees, woodlot licensees and the Small Business Forest Enterprise Program (SBFEP); but do not include backlog silviculture prescriptions and areas affected by natural disturbance, such as forest fires or insect infestations.

A total of 24,560 cutblocks were harvested and had silviculture prescriptions completed on Crown land over this time period. The total area harvested was 988,920 hectares, or about 2.5 percent of the forested area of the province.

Of these cutblocks, 6,488—or 26 percent—were scheduled to achieve free growing by August 2002. The remaining 18,072 cutblocks—or 74 percent—are scheduled to achieve free growing over the next 1 to 7 years.

This report covers the population of 6,488 cutblocks scheduled to be free growing by August 2002.

Objectives

This investigation had four objectives:

1. To determine the accuracy of record keeping; that is, did the silvicultural records and surveys reflect what was observed on the ground?

2. To verify on the ground, for 291 cutblocks in 6 forest districts, whether;

   (a) cutblocks declared as free growing in the ISIS database actually met the criteria for free growing; and

   (b) the cutblocks remained free growing after declaration, or whether insects, disease, brush, landslides or fire had overcome them.

3. To assess compliance with free-growing regulations of the Forest Practices Code for the 291 cutblocks examined on the ground.

4. Based on the silviculture database, to survey for all forest districts in the province:

   (a) the success in achieving free-growing status within the prescribed time period;

   (b) the number of cutblocks that required amendments to the silviculture prescription because they would not meet free-growing specifications within the prescribed time period, and

   (c) the number of cutblocks that did not meet the free-growing requirements and the reason why not.

Methods

Selection of Field Sample

One forest district from each of the six forest regions was selected for field inspection. The six forest districts were: Campbell River, Prince George, Arrow, Bulkley (now part of Skeena Stikine), Williams Lake (now part of Central Cariboo) and Salmon Arm (now part of Okanagan Shuswap). The selected districts all had a large population of cutblocks with due free-growing dates, and had not been the subject of a recent silviculture audit by the Board.

Approximately 50 cutblocks were selected in each district. Cutblocks chosen for field inspection were those with the highest number of risk factors. The risk factors affecting potential achievement of free growing are:

- nutrient-rich, moist sites (high brush potential);
- xeric (dry) site series (potentially high mortality);

- cutblocks with deciduous species in their inventory label (brush);
- high elevation (snow load and slower growth);
- heavy snow fall variants (snow load); and
- long distance from a district office (fewer inspections).

The ISIS database was used to identify risk factors. All selected cutblocks had at least two high risk factors.

A total of 291 cutblocks, covering an area of 15,180 hectares, were assessed in the field. This is a sample of 35 percent of the free-growing cutblocks in the six districts and 5 percent of the provincial total.

Field Assessments

A team of three, including the silvicultural forester from each district, carried out the field inspections. The team used helicopter surveys to assess the free-growing conditions of cutblocks, and the accuracy of ISIS records and silviculture surveys. The free-growing assessment was limited to the net area to be reforested (NAR) shown on the survey maps. An average of 50 free-growing cutblocks and 10 not-free-growing cutblocks per district were assessed. The not-free-growing cutblocks were examined to determine the main reasons why free growing was not achieved. They are not included in the 291 cutblocks declared free growing.

The helicopter inspection involved slow, low-elevation reconnaissance in a grid pattern over the entire cutblock. Photographs of the cutblock were taken from the air. For each cutblock, the most recent survey map was used for navigation and for assessing the cutblock. The team landed to assess cutblocks where possible issues were identified from the air.

Each stand was assessed for achievement in reaching free growing based on:

- stocking levels and species mix;
- forest health;
- brush-location, species and height; and
- minimum height.

The teams used the district's policy for the amount of area on a cutblock that can be below the minimum standards for free growing without affecting the free-growing status of the overall cutblock. The policies vary between districts.

Accuracy of the Survey and Record Keeping

Each of the 291 selected cutblocks in the six sampled districts was assessed for the accuracy of the final silviculture survey and database. Detailed plot measurements were not made, but any obvious discrepancy with the survey—and the accuracy of the ISIS record—was noted. Stratification, where areas with obvious differences were stratified out at the time of the last survey, was also assessed.

Compliance

Compliance with regulations pertinent to free growing was assessed for the 291 sample cutblocks selected from the six districts. There are eight current Code references to free growing. Compliance was assessed separately for each requirement.

Provincial Analysis

Provincial success at achieving free growing was assessed by analyzing the ISIS database. A list of all free-growing standards units (SUs)[2] was identified from the database. (A cutblock may be divided into two or more "standards units" when the tree species and site conditions are significantly different within a cutblock. Each standards unit is tracked separately and they may have different free growing due dates.)

ISIS was also used to generate a list of SUs where free growing was due, but they were not declared free growing at the time of the query. Each district was then sent the list of their not-free-growing SUs. District staff looked up the paper files and provided individual comments for every one.

ISIS was also used to generate a list of cutblocks with amendments in the stocking standards section. The recommended late free-growing dates for different site series, in the *Establishment to Free Growing Guidebook*, were used, together with the ecological information for the SU, as a method of identifying whether the amendment affected the late free-growing date. An analysis was done to determine whether the minimum height and stocking density expectations in the free-growing guidebooks were being achieved at the time of the free-growing survey. Extracting conclusions from the ISIS database was not straightforward. Details on the database analysis are described in Appendix 2.

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[2] SU means standards unit. A cutblock may be divided into two or more standards units where the site conditions vary considerably across the cutblock. Each standards unit has its own requirements for species, stocking level, etc., to reflect the site conditions.

Results

Objective 1:

A determination of the accuracy of record keeping; that is, did the silvicultural records and surveys reflect what was observed on the ground?

Overall, the silvicultural records, maps and databases were accurate and fairly represented what was observed on the ground.

Where issues or discrepancies arose, they were most commonly one of the following types:

- **Minimum stratum size**

  Of the issues identified, minimum stratum size is the most problematic. In some cases, small portions of a cutblock (less than half a hectare) will have pockets of brush, lower stocking or poor growth due to a range of micro-site conditions (such as frost pockets or saturated soil). The total amount of area in this condition is often small and dispersed throughout the cutblock.

  The forest districts have different policies on how to map out and address this stratum. Policies ranged from total discretion at the cutblock level, to identifying minimums above which mapping of new stratum and treatment is required. These criteria sometimes differed from cutblock to cutblock within each forest district. Where separate strata were not identified, it was not always possible to determine from the silviculture record how much area was affected.

- **Survey map quality**

  Of the areas reviewed, the survey map quality was often poor, with little detail provided—including the SU boundaries necessary for accurate surveying. With the advent of computer-derived base maps for silviculture prescriptions, this is likely less of an issue now.

- **Combining standards units**

  Stratification of a cutblock into SUs to promote suitable treatments and standards to meet key environmental limiting factors is extremely important. Thus, standards units with different stocking standards are appropriate. Where similar stand types result, the standards units are often combined, using the more stringent standards and simplifying the reporting and survey process. The Code regulations require an amendment if standards units are combined. In the sample, combining standards units without amending the prescription occurred more often than not, with the number of survey strata not matching standards unit strata.

- **Time delay in submitting surveys and updating databases**

  A free-growing survey needs to be carried out within the free-growing window. The submission of this information may be delayed, as is often the case with database updates. These delays result in areas being identified as not free growing in the ISIS database, even though they may actually be free growing. The use of electronic reporting may help rectify this situation.

- **Different district approaches to declaring free-growing status**

  Under the Code, there was no requirement for government to formally accept cutblocks or standards units as free growing. Instead, they were obliged to acknowledge receipt of the results of the free-growing survey and to address any cases of non-compliance. MOF policies issued in 1998 and 2001 recommended a procedure for acknowledging and declaring cutblocks (and SUs) free growing. Some, but not all, districts followed the policy. This sometimes made it difficult to tell whether districts had confirmed that submitted cutblocks were indeed free growing or not, and whether the licensees had been relieved of their obligations for the cutblocks.

- **Standards unit vs. opening**

  Most districts declare cutblocks free growing, or update the free-growing status by cutblock rather than by standards unit. MOF's *General Bulletin number 40,* dated 2001, outlines cases where the standards unit can be considered for declaration of free growing. The bulletin provides clear examples for suitability: for example when two or more standards units have significantly different early and late free-growing windows, the standards units should be considered as separate stands and be declared as standards units. District staff were often reluctant to process individual standards unit declarations, identifying the issue as one of workload and the ability to process and assess the additional standards unit submissions.

- **Changing standards in guidebooks**

  Administratively, some standards units were affected by modifications of free-growing standards (for example free-growing window, minimums and targets or modifications to suggested species). The new standards are supposed to be incorporated into silviculture prescriptions whenever they are amended. However, often the new standards were not, or were not completely incorporated into amended silviculture prescriptions. While this made it difficult, at times, to understand the ISIS data, it did not negatively affect performance.

- **Poor data in original silvicultural prescription**

  Early silviculture prescriptions did, at times, have incorrect information (such as wrong biogeoclimatic zone) that was subsequently recognized and amended. The single largest issue was not identifying wetter site series and assigning suitable minimums and targets at the prescription step. Wetter portions of cutblocks were subsequently amended. This issue

will not be as large an issue in future, as logging of wet areas adjacent to streams is now much less common.

While the above factors made it difficult to understand and interpret some of the ISIS database information, they generally did not affect achievement of free growing on the ground.

Objective 2:

Field verification (291 cutblocks in 6 districts) of whether cutblocks declared as free growing actually met the criteria for free growing; and whether the cutblocks remained free growing after declaration.

Field Assessment of Free-Growing Criteria

In order to be declared free growing, cutblocks must meet specific criteria for the stocking level (number of trees per hectare), the amount of competing brush, and minimum height of crop trees. The 291 sites were assessed against these criteria.

- **Stocking**

  In most cases, stocking was at or near target levels. Any concern that management was aimed at achieving only minimum stocking levels was not borne out by this assessment.

  While some portions within cutblocks were closer to minimums than targets, this was the exception (approximately four percent of the cutblocks viewed had a stratum that appeared near the minimum stocking standard). These areas were, in some cases, combined with the rest of the cutblock and assimilated within the reported stocking. In other cases, they were stratified out and surveyed to lower standards.

- **Brush**

  The cutblocks chosen for field verification all had a higher potential for brush competition.

  The majority of the area viewed was free of brush competition. A total of eight percent of the cutblocks viewed had an observable and identifiable level of brush competition. However, only one percent of the net area to be reforested was identified as having brush overtopping the crop conifers to a level exceeding the guidelines.

  Some areas were purposefully left untreated to maintain biodiversity, others had either been missed or were treated previously but the competing brush had regrown. The main competitors identified were hardwood species: aspen and birch in the interior, and red alder on the coast.

- **Minimum heights**

  Although minimum heights have only been required for cutblocks harvested since 1994, or for cutblocks that are amended to incorporate other changes, the sites surveyed in the field were compared to the minimum height criteria anyway.

  Only one cutblock, of the 291 sampled, failed to meet the prescribed minimum height criteria as described in the free-growing guidebook.

Free-Growing Status

In the field, assessors estimated the proportion of each of the 291 cutblocks declared free growing that actually met the free-growing standards.

Nearly all cutblocks that were declared free growing were found to be free growing on the ground.

The field survey indicates that overall 99 percent of the total net area to be reforested (NAR) was stocked and free of brush competition (% NAR FG in Table 1). The range varied among districts from 97 to 100 percent.

When a block was found to have a significant portion in brush, the free-growing rules require the entire cutblock be declared not-free-growing (% Admin Area FG in Table 2). In some cases the brush is limited to a single SU, but for simplicity the entire cutblock is tallied as not-free-growing. If the free-growing rules are applied, 2 percent of the NAR should not have been declared free growing.

Table 1. Area Considered Free Growing by Free Growing Status

District	# Cutblocks	Area (ha)	% NAR FG	% Admin Area FG
Arrow	34	1,002	100	100
Bulkley	57	3,815	99	94
Campbell River	48	2,038	98	98
Prince George	53	4,197	97	97
Salmon Arm	47	1,275	97	100
Williams Lake	52	2,853	100	100
Total	**291**	**15,180**	**99**	**98**

Results by Forest District

- **Arrow Forest District**

Overall, the 34 sample cutblocks met the free-growing requirements and had no significant issues. Some of the cutblocks were light partial cuts, where a limited number of white pine trees had been removed, leaving the cutblocks fully stocked immediately after harvesting. On a limited number of cutblocks, ISIS had not been updated to reflect the declared free-growing status. Brush was found on a number of cutblocks; however it was not at levels that would limit free-growing declaration.

Photo 1 – Uniform free-growing block with limited deciduous not limiting free growing.

Photos 2 – Brush found on this block did not limit free-growing declaration or reduce the area of free growing.

- **Bulkley Forest District**

Most of the 57 sample cutblocks had no issues. However, three cutblocks had levels of competing brush that covered a significant portion of the cutblock and would limit the achievement of free growing. Five cutblocks were considered borderline with respect to the amount of brush within the cutblock. The main competitors were alder and aspen. One cutblock had a potential problem with Dothistroma needle blight.

Photo 3 – Most blocks have achieved full stocking and are free of brush, as the block above shows.

Photo 4 – Brush was found on three blocks at levels thought to limit the achievement of free growing. Five other blocks had levels that were considered borderline.

- **Campbell River Forest District**

The 48 cutblocks viewed showed good overall conifer coverage and growth. Non-crop deciduous species were mostly located along roads and backspar trails where there had been mineral soil disturbance and, for the most part, did not adversely affect the crop conifers within the cutblocks. However, two cutblocks that have been declared free growing had considerable red alder cover overtopping conifers. Where stocking was patchy, it was mainly due to micro-site limitations, such as rock and wet depressions.

Photo 5 – Typical free-growing block. Note the deciduous trees along the road. In this case, and most observed, the levels of deciduous trees along roads did not significantly affect the net area to be reforested.

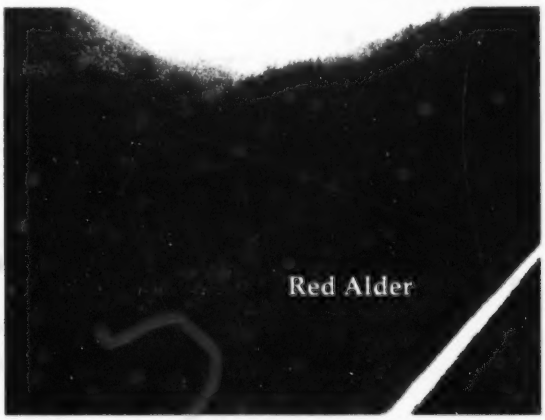


Photo 6 – Alder in the foreground is overtopping the conifers, within a block declared free growing. This is one of two blocks, out of the 48 viewed, with a competing brush issue potentially affecting free growing.

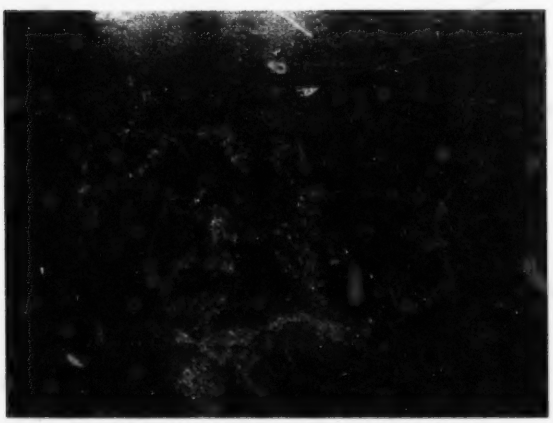


Photo 7 – On some of the steeper, more difficult blocks, existing rock outcrops limited the levels of stocking and need to be factored into the actual area to be reforested.

Photo 8 – The unmanaged area in the foreground is almost exclusively alder. The area assessed, beyond it, has been managed for conifers and is completely free growing with conifers.

- **Prince George Forest District**

Most of the 53 cutblocks were fully stocked with no issues. Aspen was the main competitor and was found in minor levels in a number of cutblocks and in excess of expected limits on one cutblock. There also appeared to be areas of non-productive ground that had not been netted out at the silviculture prescription stage, resulting in small pockets of understocking in a limited number of cutblocks. One cutblock assessed had been identified as having a gall rust problem and is being studied by the district. Terminal weevil was also an issue on one cutblock where deciduous was left overtopping the conifers, resulting in a condition that would not meet conventional free-growing criteria.

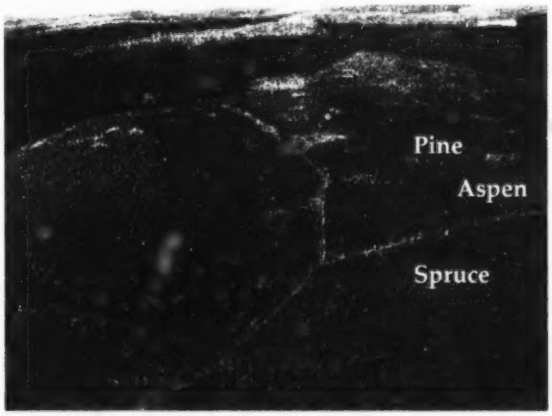


Photo 9 – Large block - one of many over 100 hectares in the sample. Most blocks had good overall stocking. This block was planted with pine and spruce. Note spruce in the foreground and pine over much of the block. Minor amounts of aspen are found within the pine area.

Photo 10 – Aspen pockets were found on a number of the blocks, most below the minimum 1 hectare guideline for stratification in the district. One block had a larger area in aspen that was not separated out in the free growing assessment.

- **Salmon Arm Forest District**

The 47 cutblocks viewed showed good stocking and few problems with brush on the sites declared free growing. The assessors found a few instances of areas within cutblocks with brush above the conifers, where the cutblock had been declared free growing four years previously, indicating that the trees had been overtopped during that period. In one cutblock, the silviculture prescription had been amended to accept deciduous species to meet visual quality objectives.

Photo 11 – Well stocked block with dispersed deciduous trees and accumulations of deciduous along the road.

Photo 12 – Mixed deciduous trees with conifers were found in a number of blocks, but the amount and distribution of the deciduous did not limit achieving free growing.

- **Williams Lake Forest District**

Few issues were identified for the 52 free growing cutblocks viewed. Minor areas of brush were noted, but did not amount to greater than 2 hectares, or 20 percent of the cutblock, which is the district's level of acceptable brush. Spruce budworm was an issue for three of the declared cutblocks. Many of the cutblocks viewed were near the early free-growing date, with trees just meeting minimum height specifications on site.

Photo 13 – Block is stocked with minor incidence of brush.

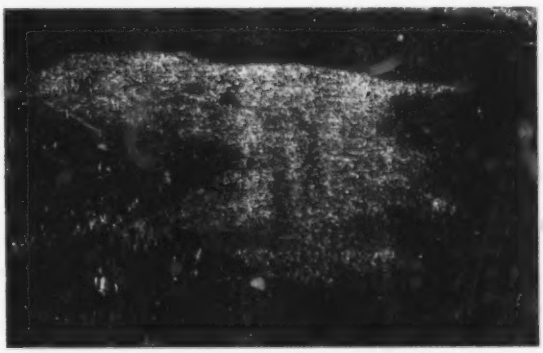


Photo 14 – Free-growing block declared near the early free-growing date. The site is stocked, despite the lack of obvious stocking from the air. It has a general lack of competing brush, making this a low risk for early declaration of free growing.

Objective 3:

An assessment of compliance with free-growing regulations of the Forest Practices Code for the 291 cutblocks.

Compliance with legal requirements for free-growing status was assessed for the sample of cutblocks selected from each district.

> ***In all significant respects, the licensees in the six sample districts are in compliance with the Forest Practices Code requirements for free growing.***

Table 2 shows the regulatory requirements that apply to stands scheduled to be free growing. The overall compliance with each regulation is described in the third column.

Table 2: Assessment of Compliance with Code Requirements

Regulation	Code Reference	Compliance
Where a mixed species was present in the area before harvesting, has the licensee regenerated using a mix of species that is ecologically suited to the area?	*Operational and Site Planning Regulation*, section 41	Species in all stands consistent with SP. All SPs consistent with guidebook recommendations. Mixed stands achieved through natural regeneration.
Has the licensee kept within limits for seed or vegetative material transfer specified in the *Seed and Vegetative Material Guidebook*?	*Silviculture Practices Regulation*, section 38(2)	One cutblock with off-site seed transfer.
Has regeneration delay been met by the date specified in the SP?	Forest Practices Code, section 70(4)(d)	All regeneration delay targets met.
Has a free-growing stand been established that's within the free-growing assessment period specified in the SP?	Forest Practices Code, section 70(4)(e)	20 of 510 SUs failed to meet original free-growing dates. All late SUs had free-growing dates amended in SPs.
Has the licensee carried out surveys at the time and in the manner specified in the regulations and standards?	Forest Practices Code section 70 and *Silviculture Practices Regulation*, sections 23-27	All surveys carried out on time. Survey methods consistent with the standards.
Has the licensee submitted the required report regarding free-growing requirements?	Forest Practices Code, section 70(4)(i) and *Timber and Silviculture Practices Regulation*, section 46	All cutblocks had required reports submitted by licensee.
Where a survey indicates that the requirement for the prescription cannot be met, has the licensee made the necessary changes to the SP?	Forest Practices Code, sections 36(2)(b), and 36(3)(b)	SP amendments were made in all required cases.

Objective 4:

A survey, using the ISIS database, for each district in the province, of:

A. success in achieving free-growing status within the prescribed time period;

B. the number of cutblocks that required amendments to the silvicultural prescription because they would not meet free-growing specifications within the prescribed time period, and

C. the number of cutblocks that did not meet the free-growing requirements as well as the reason.

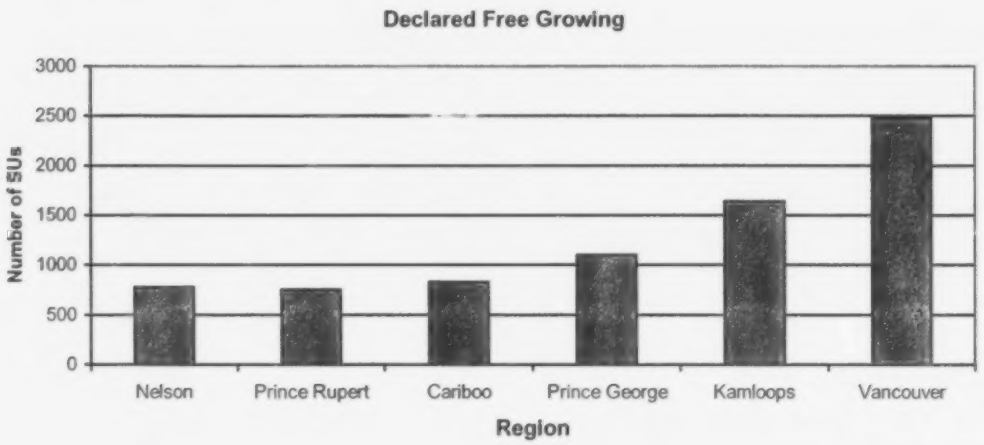
A. Success in Achieving Free Growing

- **Proportion of area free growing**

A total of 7,581 standards units (5,351 cutblocks) were logged between 1987 and 1992 and have now been declared free growing. This represents 83 percent of the NAR for the 6,448 cutblocks that originally had a late free-growing date earlier than August 2002.

As shown in Figure 2, the Vancouver Forest Region has the largest number of cutblocks declared free growing, due to the shorter time required to achieve free-growing status on faster-growing coastal sites.

Figure 2. Number of standards units declared by forest region



The total area reforested and declared free growing is 191,483 hectares. From the field survey, 1.5 percent of the cutblocks identified as free growing, in fact, had a portion of the cutblock that did not visually meet the free-growing criteria. Therefore, if this correction factor is applied to the entire province, 187,653 hectares would be free growing. This is 82 percent of area that was supposed to be free growing by August 2002.

- **Achieving free growing within the prescribed time**

The silviculture prescription states the number of years after logging that a cutblock or standards unit has to achieve free-growing status. At a minimum, free-growing status cannot be achieved for five years following regeneration.

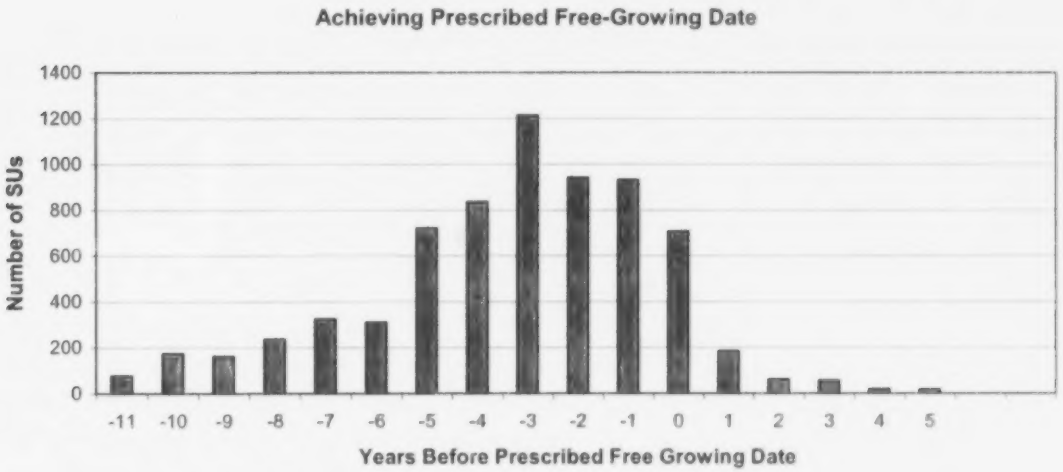
The study assessed whether the target date for free growing was met for those cutblocks declared free growing. A difference was calculated between the prescribed free-growing date and the actual date of declaration (Figure 3). The prescribed free-growing date is not necessarily the original late free-growing date, as the date can be amended at any time. It is also recognized that administrative process can add one year to the date beyond the free-growing survey. Amendments are discussed in the next section.

Of 5,202 cutblocks that met free-growing status before the late free-growing date, mean declaration was 3 years before the prescribed late free-growing date. Free-growing approval ranged from 11 years early to 6 years late, with 80 percent of the cutblocks declared between 0 and 5 years early.

NOTE: Free-growing declarations of 10 or 11 years before late free growing are in partial cutblocks, where a limited number of trees were removed and the cutblock is still free growing on the date of logging.

A total of 149 cutblocks were approved more than one year after the prescribed late free-growing date, without an amendment to the silviculture prescription.

Figure 3. Number of standards units achieving prescribed free-growing date



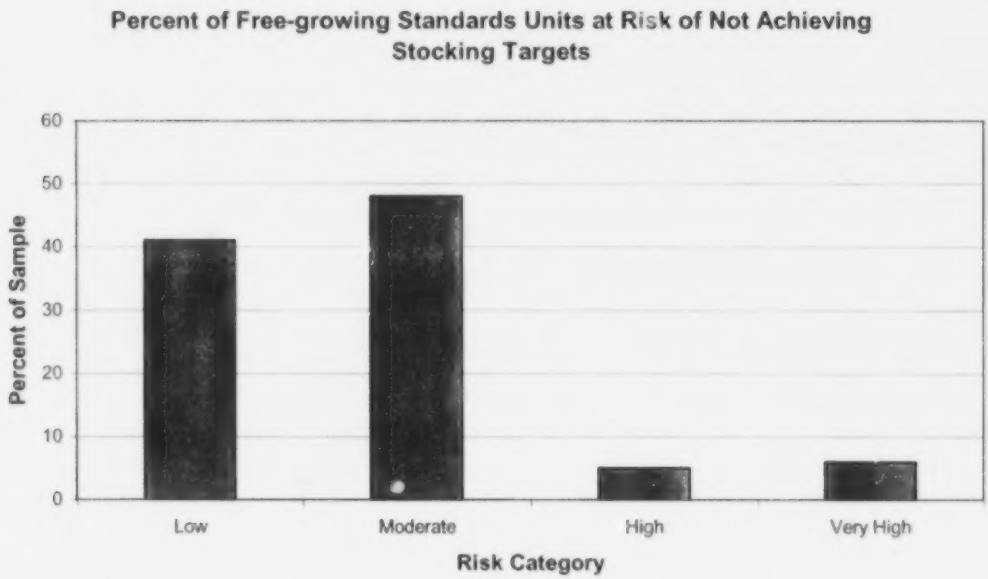
- **Managing to minimum stocking**

An analysis was done to compare the well-spaced stocking of free-growing trees to the minimum and target standards described in the guidebooks.

Risk categories were defined as the risk to the Crown of accepting stands that may not achieve their full potential. A stand is considered low risk if the total number of free-growing stems per hectare is within 100 stems per hectare of the target stocking. A stand is considered very high risk if the total number of free-growing stems is within 100 stems per hectare of the minimum stocking.

At free growing, 90 percent of the reforested area is being managed near target stocking levels (Figure 4). Only six percent of the free-growing cutblocks had a very high risk of not achieving minimum targets, and an additional four percent had a high risk.

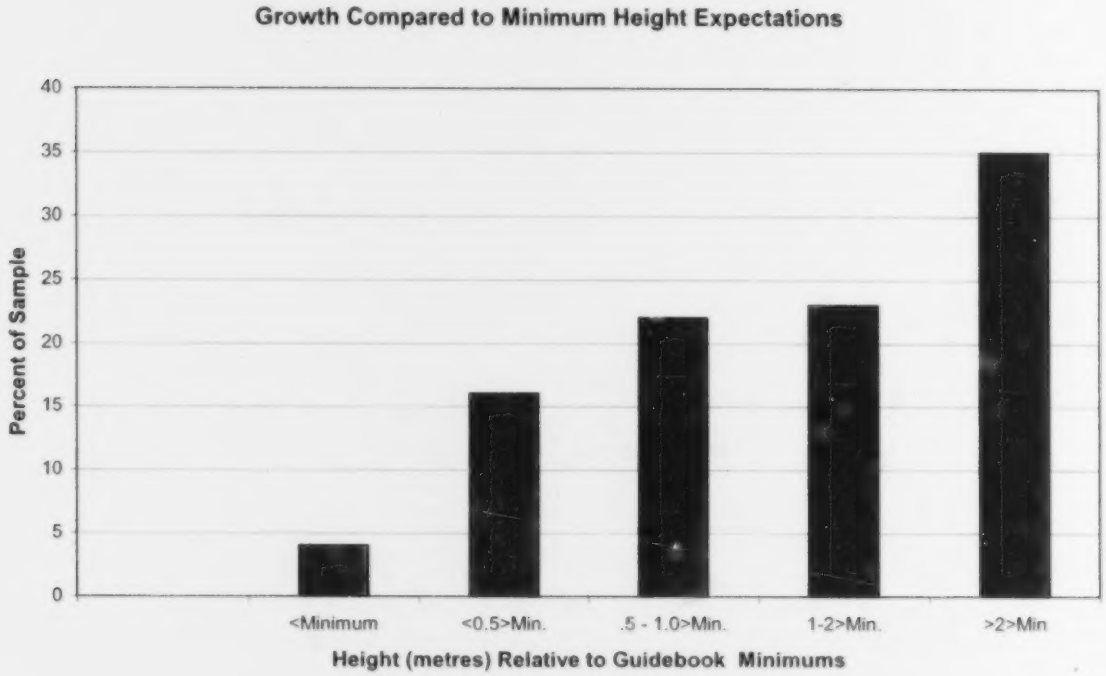
Figure 4. Percent of free-growing standards units at risk of not achieving stocking targets



- **Minimum height expectations**

The study analyzed the proportion of cutblocks that met or exceeded the minimum height standards for that site series and species described in the guidebook. As all of the cutblocks were harvested before 1994, there is no legislated requirement to meet minimum height requirements at free growing, unless a silviculture survey was conducted after 1999.

Figure 5. Growth compared to minimum height expectations



The ISIS database indicates that minimum free-growing heights are being achieved within the legislated time frames. Only 4 percent of cutblocks had trees at or below minimum heights, while 16 percent were within 0.5 metres of minimums at the time of the free-growing survey (Figure 5). The field survey of 291 cutblocks corroborated this finding, as less than 1 percent of the cutblocks failed minimum height expectations.

It appears that the minimum height criterion is easily met.

B. Cutblocks that Required Amendments to the Free-Growing Date

The silviculture prescription can be amended at any time, allowing for changes to stocking standards, the site classification, the net area to be reforested, the late free-growing date, or to create new SUs within the opening.

The total number of amended SUs in the province had to be extrapolated from a smaller sample (see Appendix 2). An estimated 2,882 stocking standard amendments were made on standards units for cutblocks logged between 1987 and 1992.

Standards units on approximately 918 cutblocks had the free-growing date extended. This represents an area of 21,300 hectares, which is 8 percent of the net area to be reforested.

The use of free-growing date amendments is highly variable between districts. For example, one district had 67 amendments, while 9 districts had none.

Amending the silviculture prescription to alter the free-growing date has also occurred for an additional 202 SUs that were logged after 1992 and have not yet reached their original free-growing date. This covers cutblocks harvested from 1993 to 2002. In other words, the licensees are already anticipating the cutblocks will not reach free-growing status by the required date and have modified the late free-growing date. Again, the use of this option is highly variable, with three districts accounting for 80 percent of these early amendments.

Provincially, 52 percent of the free-growing date amendments were on SUs less than 5 hectares in area. This small area reflects the practice of amending the silviculture prescription to create a new SU for an underperforming portion of the cutblock and then extending the free-growing date for this new SU.

When prescriptions were amended to extend the late free-growing date, an average of 4.6 years was added. Very few amendments were for less than 3 years, and 7 amendments were for greater than 10 years.

C. Cutblocks that Did Not Meet the Free-Growing Requirements and the Reason.

> ***Provincially, 220 cutblocks logged in the 1987-1992 period have not met free-growing criteria by the late free-growing date. The total area of not-free-growing cutblocks is 10,548 hectares, or 4 percent of the net area to be reforested.***

According to the districts, 67 of these cutblocks have active compliance and enforcement investigations, and 104 are possible contraventions being examined by the district. The number of non-compliant cutblocks is distributed across all tenure types—major licensees, woodlot licensees and the SBFEP.

Licensees had declared an additional 96 cutblocks free growing, however the free-growing date had expired and the district has not yet had time to verify in the field that cutblocks are indeed free growing. For the purpose of this analysis, these cutblocks were excluded.

The districts offered a variety of reasons why these cutblocks failed to meet the free-growing target, including:

- excessive brush (74 percent)
- licensee had gone bankrupt (10 percent)
- failure to conduct a survey on time, or unacceptable survey (3 percent)
- difficulty in regeneration with poor stocking on parts of the standards unit (10 percent)
- seedling stock from incorrect biogeoclimatic zones (1 percent)
- maximum density exceeded (too many trees on site) (1 percent)

- failure to meet minimum height specifications (1 percent)

Based on our field observations, the majority of the cutblocks that did not achieve the free-growing date are probably regenerated, but are not declared free growing because of brush occupying a small portion of the cutblock.

Discussion

Harvest Date and Treatment Regimes

The cutblocks reviewed were harvested between 1987 and 1992. The harvesting and treatment regimes used in this period may not fully reflect current practices. For example, the use of large cutblocks was more common during this period, before maximum cutblock size limits were introduced under the Forest Practices Code in 1995. The area treated by broadcast burning was 1.5 times larger in this period than in the preceding five years, and twice as large as the following five year period.[3] As well, there was a four-fold increase in area brushed using herbicides in this period, compared with the preceding five years, with a relatively consistent rate for the following five-year period.

New forestry approaches such as variable retention harvesting and leaving more trees and vegetation to meet biodiversity and wildlife objectives have become more common in recent years. Thus, while this assessment provides successful results based on the regimes of the day, additional assessment to determine the success of more recent harvesting and treatment regimes will be required.

Silvicultural Treatments

The high success rate for achieving free-growing status in these cutblocks was only obtained through a significant regime of silvicultural treatments. The percentage of cutblocks by treatment method is summarized by district in Table 3. In the Campbell River district, for example, 100 percent of the cutblocks were planted, 70 percent were fill planted, 43 percent were herbicide brushed, 33 percent received second mechanical brush treatment and 45 percent were also partial brushed between 1 and 14 times. Finally, four percent of the cutblocks were fertilized. In the Prince George district, all cutblocks were planted, 35 percent were fill planted to some extent, 24 percent had chemical brushing, 8 percent had 2 or more treatments, and 14 percent had partial treatments. Interestingly, 35 percent of the cutblocks were broadcast burned and planted without any brushing, but still resulted in free-growing stands.

[3] From Just the Facts, Web site located at http://www.for.gov.bc.ca/hfp/forsite/jtfacts/2-1-2c-silv-prep-burn.htm

Table 3: Summary of treatments on inspected cutblocks (%)

District	Burned	Planted	Fill Planted	Herbicide	Mechanical Brushed	Partial Brushed	Fertilized
Campbell River	0%	100%	70%	43%	33%	45%	4%
Prince George	36%	100%	35%	24%	8%	14%	0%
Arrow	50%	78%	26%	0%	33%	25%	0%
Bulkley	40%	98%	40%	2%	48%	24%	0%
Salmon Arm	64%	100%	23%	8%	35%	23%	0%
Williams Lake	6%	22%	11%	0%	37%	39%	0%

Species Diversity

The cutblocks viewed were reforested in an era when single-species planting within areas was the norm. The species used were considered "preferred" and "acceptable," as described in the silviculture prescriptions.

Mixed bag (multiple species held in the planter bag), where planters are directed to plant species and stock types to match specific environmental conditions, was not used much. Since then, more prescriptions have incorporated mixed species and planting to match the planted species to specific attributes of the cutblock, such as shade tolerance. While single species planting was the most prevalent, we did note cutblocks with portions planted with different species, resulting in a mix of species at the landscape level.

Timber Supply Review Issues

Where timber supply review growth predications are based on stocked stands, they appear consistent with the cutblocks that have been declared free growing. Most cutblocks reviewed were fully stocked with preferred and acceptable conifer species. The ISIS analysis indicates that, at free growing, 90 percent of the reforested area is being managed near target stocking levels. Furthermore, the field survey indicates that overall, 99 percent of the total net area to be reforested (NAR) was stocked and free of brush competition. These brushy areas, if found in a survey, would have resulted in approximately one percent of total area not being declared free growing.

This would indicate a low Operational Adjustment Factor (1) in TASS simulations for timber supply forecasts. For timber supply review, the OAF1 of 15 percent for non-fully stocked sites appears to be conservative.

Conclusions

Overall, the results from this provincial examination of free growing are very good. The standard of record-keeping is generally complete and current. Compliance with regulatory requirements is complete in all significant respects. Silvicultural databases document satisfactory achievement of free-growing status across the province. Field examination of cutblocks declared free growing showed excellent results on the ground.

The free growing status of the cutblocks harvested on Crown land between 1987 and 1992 is summarized in Table 4.

Table 4. Provincial summary of free growing status, based on ISIS

	Number of cutblocks	Hectares	Percentage of area to be reforested
Total number of cutblocks	24,560	988,920	
Number of cutblocks scheduled to be free growing by August 2002	6,488	232,158	100 %
Cutblocks declared free growing before the late free-growing date, still free growing	5,098	189,570	82 %
Cutblocks that missed the free-growing date but are now free growing	148	7,100	3 %
Cutblocks declared free growing before the late free-growing date, but no longer free growing	104	3,640	1.5 %
Cutblocks that missed the free growing date, still not free growing	220	10,548	4.5 %
Cutblocks with amended free-growing dates, not yet free growing	918	21,300	9 %

Free-growing cutblocks that met the original free-growing date and are still free growing are 82 percent of the population; an additional 3 percent missed the original free-growing date, but are now free growing.

This free-growing population was surveyed in the field in six districts; all surveyed districts had excellent results. Cutblocks currently declared as free growing still meet the criteria for free growing in almost all cases. Even in high-risk cutblocks, 98 percent of the cutblocks and 99 percent of the actual area to be reforested was verified as free growing.

In most cases, there has been cooperation between licensees and the Ministry of Forests to identify problems early in the regeneration cycle, and to act upon them quickly to minimize problems. Where free-growing problems are anticipated, amendments of the free-growing date to a later date occurred in nine percent of the cutblocks. Based on our survey observations, the majority of amended free-growing cutblocks are the result of a few hectares of brush occupying a small area within the cutblock, thereby preventing declaration of the entire cutblock.

Potentially non-compliant cutblocks (220) are 4.5 percent of the total. The scope of this study did not allow for investigation into the details of each of these cutblocks. However, districts have active compliance and enforcement files on only 35 percent of these cutblocks.

The investigation examined the individual criteria for assessing free-growing status. Specifications for minimum height, minimum stocking densities, free of disease, and timing windows are being easily met on the majority of sites. Making brush standards is by far the biggest challenge.

The Board was also interested in free-growing status as a case study in results-based management. Free-growing status is a desired result with clearly specified indicators for measuring success. There are no legislated silvicultural treatments (such as brushing) for achieving it. In response, licensees invested in numerous treatments on each cutblock, ultimately resulting in high achievement of free-growing stands. In this case, results-based management is working.

Commentary

These early results from the first set of cutblocks harvested under the objectives of the silvicultural regulation are very encouraging. They are the net result of the hard work and cooperation by licensee and government foresters, technicians, seedling producers and silvicultural crews.

The science of forestry has become increasingly complex since the silviculture prescriptions for these cutblocks were written some 10 to 15 years ago. Other values, such as biodiversity and wildlife habitat, have gained importance and now get equal consideration to free-growing objectives. Practices such as large clearcuts, broadcast burning and herbicide application have become less acceptable. It may be more difficult to accommodate free-growing objectives in silviculture prescriptions in the future.

Forestry professionals in British Columbia have proved their success in achieving free-growing status on the ground. Their efforts need to be supported with information exchange, training, and research and development support to ensure that this good result continues.

Free growing objectives were the first clearly established objectives in the Forest Practices Code. Free-growing status is a desired result with clearly specified indicators for measuring success.

There are no legislated steps that must be followed to achieve it—professionals must use their judgment and apply appropriate prescriptions and treatments to obtain a free-growing stand of trees. The free growing example provides a track record and reassurance that licensees and forestry professionals are up to the task, provided they have clear and measurable objectives to aim for, and measurable standards to assess progress along the way.

Recommendations

The Board encourages everyone involved in regeneration to continue the practices and commitment that have achieved such good results, to ensure future regenerated stands achieve and maintain free-growing status. This investigation shows achievement of free-growing status for cutblocks harvested between 1987 and 1992 has been very successful. The first 26 percent of these cutblocks to reach the free-growing date are mostly well stocked with healthy young stands of new trees.

There are two areas the Board wishes to highlight to ensure continued success and accurate information in the future. In accordance with section 185 of the *Forest Practices Code of British Columbia Act*, the Board makes the following recommendations.

- **Ensure measurable and enforceable objectives**

1. Government should establish more enforceable standards for determining non-compliance with free-growing requirements for the results-based legislative regime. Provincially, government should set a maximum stratum size/proportion of the NAR that can exceed standards, and should hold the late free-growing date firm. In cases of non-compliance, officials can either accept the due diligence defence, or assign an administrative penalty. In either case, responsibility for, and the incentive to bring stands to a free growing condition, would remain with the licensee and would necessitate a change to the late free growing date. Together these would provide a measurable standard for enforcement, rather than a moving target, and would stop the existing ability to continuously extend the free-growing date to avoid non-compliance.

- **Ensure accurate and relevant data**

2. Government should maintain the provincial ISIS database and ensure that it is correct and current. It is a valuable tool for assessing the status of regenerating stands across the province. Government should promote electronic updating of ISIS by licensees. It would also be valuable to create a special category to track change in late free-growing dates within the database, so the Ministry of Forests knows when the free-growing date has been amended.

Appendices

Appendix 1

Free-growing Requirements

There are a number of requirements for a stand to be declared free growing. The terms are somewhat technical and rely on an agreed upon sampling procedure. The following is meant to help explain the concept of free growing.

Free growing is based on a number of factors:

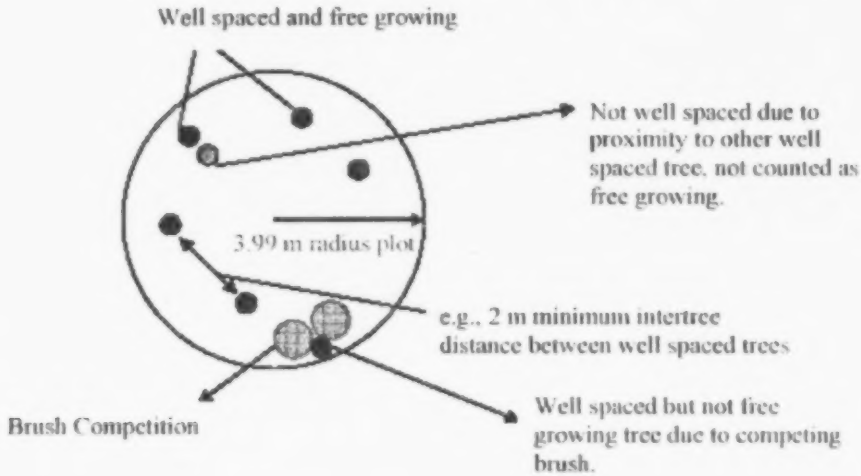
- A minimum number of healthy well-spaced trees of the preferred and acceptable species, but less than a maximum number allowed per hectare, are established and distributed to meet objectives for the site. Examples of objectives: volume production, production of high-value timber products and grizzly bear habitat. The objectives are outlined in plans covering the planning area and interpreted in the silvicultural prescription.
- The established trees must be ecologically suited to the site.
- Preferred species—management actions are primarily aimed at establishing these species. There is a requirement to have a minimum number of preferred species per hectare on site.
- Acceptable species—are suited to the site, but due to lower reliability or relative productivity, management actions are not aimed at establishing them. Acceptable species can make up a limited portion of the minimum number of free growing stems.
- The regenerated stand must be established for a minimum of five years (except for some high elevation zones, where the establishment period is eight years).
- Free growing trees must be free of brush competition. They must be either 150 percent of the height of the competition in good growing areas or 125 percent of the height in areas of slower growth competition.
- Trees must not exceed the unacceptable infection and damage criteria.
- Trees must meet minimum height requirements for the site type (applies only to post-1994 cutblocks or those amended to incorporate new requirements).

An opening may consist of more than one ecological unit. Due to variations in site productivity, species suitability and stocking levels vary by site. To account for this, areas with similar ecological characteristics are combined and termed a "standards unit" (SU), which must achieve uniform standards for free growing, such as minimum stocking standards, preferred and acceptable species and minimum intertree distance criteria.

Sampling for free growing is a legal requirement and is done by SU within the free-growing window. Tree quality, density and distribution criteria are in place that determine whether a tree can be considered as free growing. A minimum intertree distance is used to select well spaced trees. The minimum distance is usually two metres, unless described otherwise in the silvicultural prescription (Figure 1).

See the web link for the *Establishment to Free Growing Guidebooks* by Forest Region for more detailed information on specific requirements and guidance.
http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/FREE/EFG-Van-web.pdf

Figure 1. Example of choosing free-growing stems.


Well spaced and free growing
Not well spaced due to proximity to other well spaced tree, not counted as free growing.
3.99 m radius plot
e.g., 2 m minimum intertree distance between well spaced trees
Well spaced but not free growing tree due to competing brush.
Brush Competition

Steps in Declaring a Cutblock Free Growing

Step 1. To declare a cutblock free growing, the licensee commissions a free-growing survey.

Step 2. If the survey shows that a free-growing stand cannot be achieved within the free growing assessment period, the Code requires a report be submitted explaining why the requirements of the silvicultural prescription cannot be met.

Step 3. The licensee then submits the results to the district manager, (a free-growing declaration).

Step 4. The district staff reviews the submission and assesses the risk that it is not achieving free growing in order to allocate field checking.

Step 5. The district manager usually sends a letter accepting the free-growing submission, but there is no requirement to do so.

Appendix 2

ISIS Database Analysis

The Free-Growing Record

An ISIS query was made for all free-growing SUs on tenures held by major licensees, woodlot licensees and the SBFEP that were logged between 1987 and 2002. It did not include backlog silvicultural prescriptions and areas disturbed by natural disturbance.

Associated tables included land information, ecological information (biogeoclimatic ecosystem classification site series), denudation date, total area NSR, early free-growing date, late free-growing date, inventory label and silviculture label. One opening can have more than one SU; and each SU can have more than one ecological stratum or forest cover polygon.

The Not-Free-Growing Record

ISIS was used to generate a list SUs that have a due free-growing date, but were not declared free growing at the time of the query. This list was fraught with errors and only provided a starting point for creating a list of cutblocks that had missed the late free-growing date. Over a third of the entries had nothing entered for the late free-growing date, which in ISIS causes a default to the disturbance date as the late free-growing date (or used a fictitious date such as 9999-12-31). Other problems encountered were: data entry errors, cutblocks that were partial cuts, hence were still free growing, no free-growing requirement as harvested prior to 1987, or was a research trial.

In order to proof this list, each district was sent the list of ISIS not-free-growing cutblocks in that district. District silviculture staff then looked up the paper files for every opening on the list and provided individual cutblock comments. This district analysis was used to generate a current list of cutblocks harvested between 1987 and 1992 that missed the late free-growing date and had not been amended.

The Amended Stocking Standards Record

An ISIS query was made for a list of cutblocks with amendments in the stocking standards section. The output database reported all SBFEP stocking standards amendments since 1987, but only the stocking standard amendments for major licensees and woodlot licensees since 1998. This sample is 10 percent of the population of cutblocks of all major licensee and woodlot licensee cutblocks back to 1987. This is because prior to 1998, all major licensee and woodlot licensee cutblocks were managed under the Major Licensee Silviculture Information System (MLSIS). MLSIS tracked amendments, but provided no information regarding which section of the silvicultural prescription had been amended. Once MLSIS was merged into ISIS, amendments could be tracked more specifically by section.

In the sample set, a total of 1,432 SUs have been amended for stocking standards reasons from 1987-2002. Considering only those cutblocks harvested between 1987 and 1992, there were 540 stocking standard amendments of SUs.

Only a portion of these amendments extended the late free-growing date. A total of 172 SUs logged in the 1987-1992 period had their free-growing date amended (78 of these were recorded in an ISIS search, 94 were not). The ISIS database for amended cutblocks is representative of a sample of only approximately 10 percent (8 percent by area and 11 percent by number of SUs) of the total record. Extrapolating these figures to the entire free-growing dataset indicates approximately 918 SUs, with an area of 21,300 hectares, were logged between 1987 and 1992, and subsequently had the free-growing date amended, which is 8 percent of the net area to be reforested.

Even ISIS does not track detailed information on what specific component of the stocking standard was amended (such as late free growing date, minimum stocking, and change in preferred and acceptable species). Thus, ISIS was not able to provide a list of cutblocks that had the late free-growing date amended without going through a paper/opening file verification process.

Furthermore, when ISIS tracks the amendment, it only tracks it on an opening basis. Therefore it reports all of the SUs associated with an opening in the report query database, rather than specifically identifying which SU within the opening was amended.

Because of these limitations in the ISIS database, we utilized the *Establishment to Free Growing Guidebook's* recommended late free-growing dates for different site series with the ecological information for the SU as a method of identifying whether the amendment was associated with the late free-growing date. The procedure was:

1) convert all old biogeoclimatic ecosystem classifications (BEC) for SUs to the current BEC;

2) develop a database of recommended late free-growing dates for every BEC site series based on the *Establishment to Free Growing Guidebook* tables; and

3) compare the late free-growing date time period with the guidebook database to identify cutblocks that exceed the recommended time period.

This method does not recognize that the district manager has the discretion to accept silvicultural prescriptions that are different from the guidebook.

Achieving Minimum Height

An Excel database was extracted from ISIS, showing leading species, height and site series for every forest cover polygon within every free-growing SU. Corresponding recommended minimum heights were then cross-referenced from an Excel table that the guidebook recommended.

Managing to Minimum Stocking

An Excel database extracted from ISIS compared well-spaced stocking of trees at free growing to the target and minimum acceptable recommended in the free-growing guidebooks.

PO Box 9905, Stn Prov Govt
Victoria, British Columbia
Canada V8W 9R1

Phone: 250-387-7964
Fax: 250-387-7009
Toll free: 1-800-994-5899
E-mail: fpboard@gems9.gov.bc.ca

Information on the Board is on the
Internet: http://www.fpb.gov.bc.ca